

Belle II Physics Analysis Center in India

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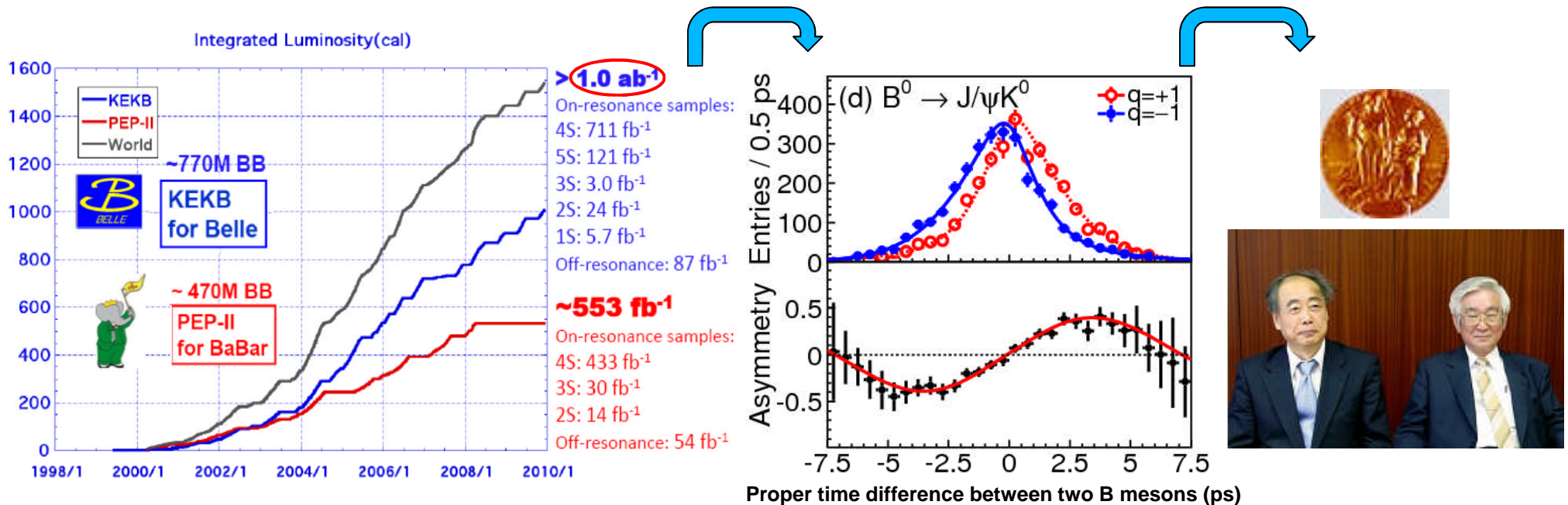
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Outline of the Talk

- Introduce Belle II Collaboration
- Belle II PAC in India – An Overview
- Computing Element – Storage
- Computing Element – CPU
- Networking between India and Japan
- Summary and Prospects

What is the Fuss about?

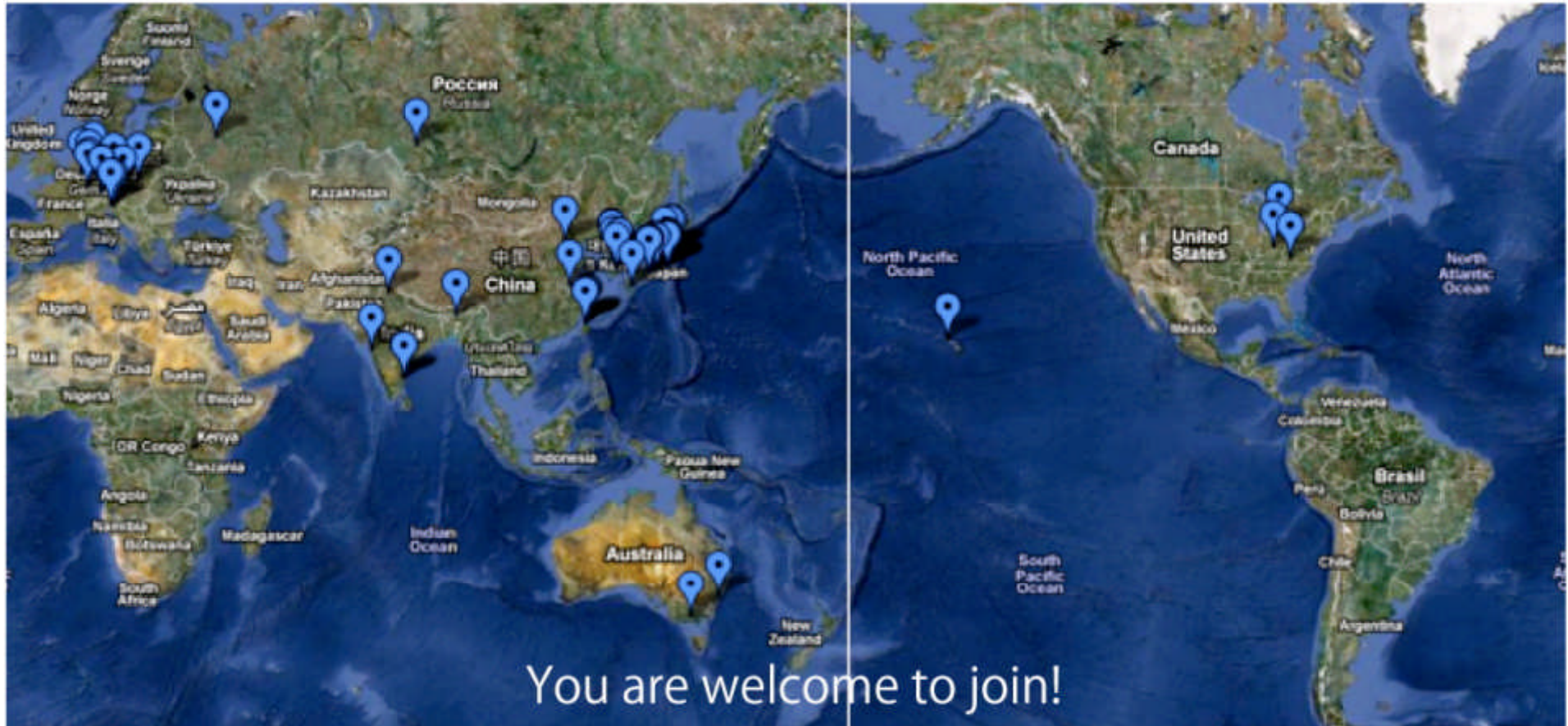
- Belle at the KEKB factory ended its successful operation on June 30, 2010
- Together with BaBar, provided the much sought-after verification of the Kobayashi-Maskawa mechanism for CP violation in the standard model



- The approved upgrade, Belle II experiment at SuperKEKB, will collect about **50 times more data** to search for the holy-grail of physics beyond the SM using **rare decays of B, D mesons and τ leptons** as a probe
- Computing is an important component of this experiment

Belle II Collaboration – A Demographic Sketch

- Consists of around 400 physicists and engineers from 62 institutions in 17 nations (still growing!)



- Five Indian institutes, *viz.* TIFR Mumbai, IMSc Chennai, IIT Madras, IIT Guwahati and Punjab University (Utkal University may join soon), are participating with the experiment

Belle II PAC in India – An Executive Summary

- ❑ Plan to set up the Belle II physics analysis center at TIFR Mumbai
 - Shall be well supported by local analysis centers at IMSc Chennai, IIT Madras, IIT Guwahati and Punjab University
- ❑ Dedicated network connectivity to KEK for a seamless transfer of data round the clock
- ❑ Will provide approximately 2k HEPSpec06 computing power and 200 TB RAID based storage by 2015
 - Open source software with EGEE middleware
- ❑ Computing resource and storage to be made available to the entire collaboration
- ❑ Explore the possibility of taking offline experimental shifts from India
- ❑ Already have a good experience with the Tier2 center for CMS and are well conversant with the grid technology

Computing Resources – Storage

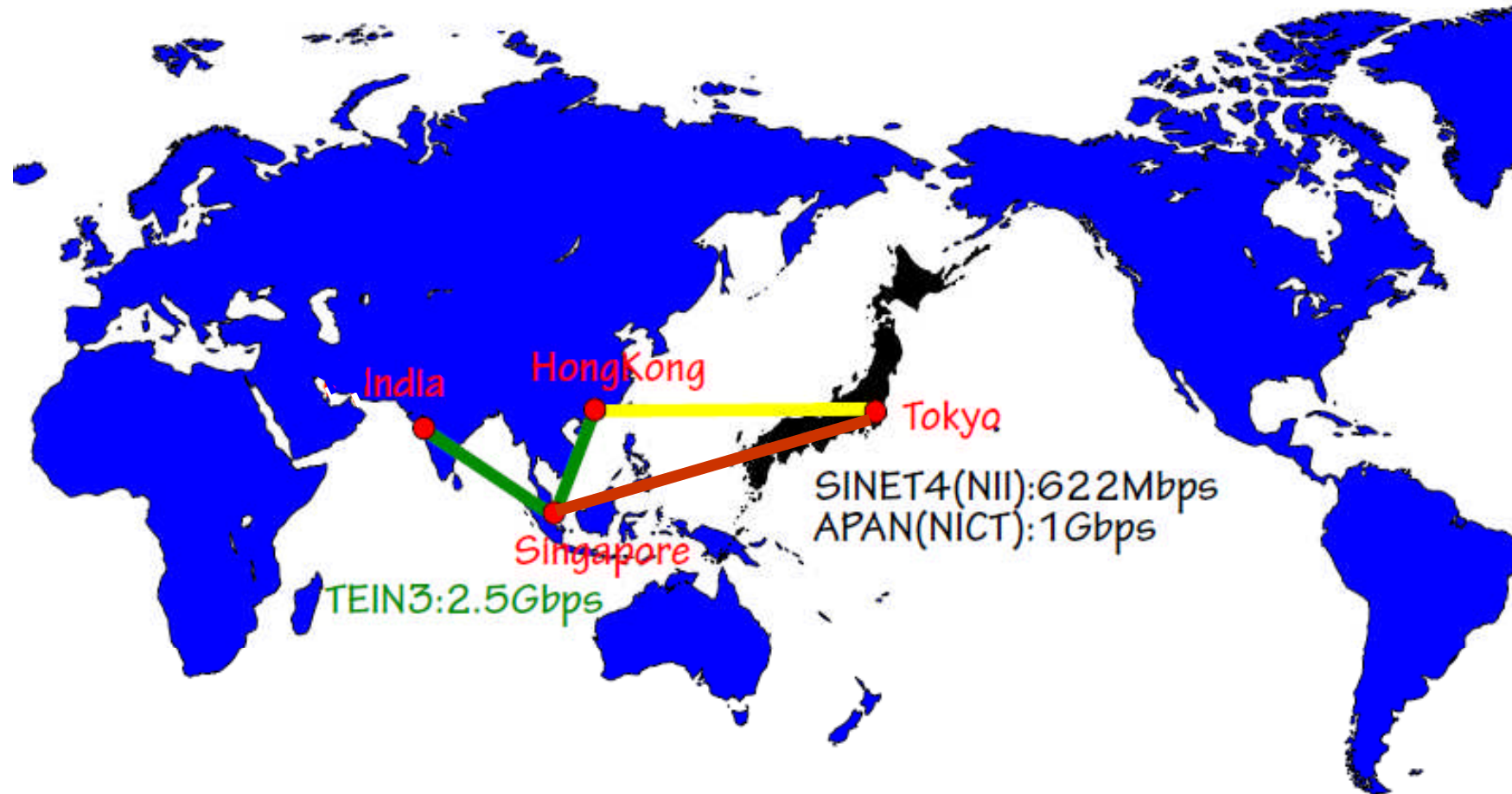
- ❑ 200 TB RAID based storage by 2015
- ❑ RAID6 with a sustained throughput
- ❑ 60 TB in 4U Form Factor with a strong gateway server
- ❑ Running Scientific Linux out of the box with XFS
- ❑ EGEE middleware can be used
- ❑ Efficient usage of the floor-space and power

Computing Resources – CPU

- ❑ 2k HepSPEC06 possible by 2015
- ❑ QUAD server Dual Processor Quad Core/Six core CPUs in 2U form factor [Westmere 5620] and above
- ❑ Each server giving roughly 100 HepSPEC06
- ❑ Running Scientific Linux 5.5 or above
- ❑ Managing servers, worker nodes, User Interface (UI), DNS etc.

Computing Resources – Networking

- Two network paths exist between TIFR and KEK; the preferred route is **TIFR→[NKN-TEIN3]→SINET4** via Singapore

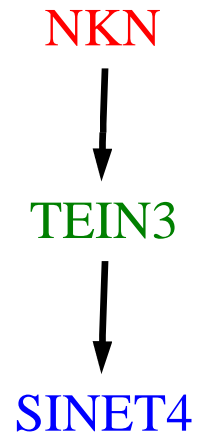


- Performed the iperf (v2.0.5) test to check several TCP and UDP throughputs using designated machines at TIFR as well as KEK as both server and client
- Varying parameters are used to get an optimum result

Networking – Part II

Results of traceroute

```
[pvd@ui ~]$ traceroute 130.87.105.175
traceroute to 130.87.105.175 (130.87.105.175), 30 hops max, 40 byte packets
 1 144.16.111.1 (144.16.111.1) 0.187 ms 0.161 ms 0.152 ms
 2 202.141.153.22 (202.141.153.22) 0.218 ms 0.211 ms 0.202 ms
 3 10.152.12.5 (10.152.12.5) 2.314 ms 2.370 ms 2.467 ms
 4 in-pr-v4.bb.tein3.net (202.179.249.90) 2.196 ms 2.274 ms 2.292 ms
 5 mb-xe-01-v4.bb.tein3.net (202.179.249.89) 2.013 ms 2.049 ms 2.040 ms
 6 sg-so-06-v4.bb.tein3.net (202.179.249.81) 64.399 ms 64.388 ms 64.397 ms
 7 jp-pop-sg-v4.bb.tein3.net (202.179.249.78) 131.007 ms 130.991 ms 130.982 ms
 8 tokyo-dc-gm2-ae1-vlan74.s4.sinet.ad.jp (150.99.2.85) 131.214 ms 131.208 ms 131.201 ms
 9 tokyo-dc-rm-ae4-vlan10.s4.sinet.ad.jp (150.99.2.53) 131.193 ms 131.210 ms 131.201 ms
10 kek-lan-1.gw.sinet.ad.jp (150.99.190.182) 300.530 ms 300.543 ms 300.571 ms
11 130.87.4.42 (130.87.4.42) 299.370 ms 299.631 ms 299.474 ms
12 perfsonar-test1.kek.jp (130.87.105.175) 299.735 ms !X 299.502 ms !X 299.528 ms !X
[pvd@ui ~]$v
```



Next to-do in our list

- In contact with the NKN authorities regarding a BGP peering in Singapore → discussed the issue in details with network experts from Japan in the sideline of the APAN32 meeting in Delhi
- Once the link is established, we are on the job!

Summary and Prospects

- ❑ We are in a very good position to hoist the Indian Belle-II PAC at TIFR Mumbai
- ❑ Thanks to our experience with the CMS Tier-2 center → great synergy between the energy and luminosity frontiers
- ❑ Modulo the possible BGP peering in Singapore, all other essential ingredients are in place
- ❑ Plan to carry out a full-scale mock test between TIFR and KEK once the pairing is established
- ❑ We will attend the Belle II Grid Site meeting in Germany as a further boost to this endeavor
- Many thanks to T.Hara-san, S.Suzuki-san (KEK), Thomas (Karlsruhe), Martin (Melbourne) and others for their active help and support